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Worker turnover at the firm level and crowding out of lower educated workers*

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Abstract

In The Netherlands, as in many countries: unemployment rates of lower educated workers are higher and more cyclical than unemployment rates of higher educated workers. In this paper we test whether this is caused by the fact that more highly educated individuals occupy simple jobs in cyclical downturns. We use a unique firm-worker dataset to investigate this hypothesis. In addition, we examine to what extent workers with more years of schooling earn higher wages than their less educated colleagues at the same job level in the same firm. We find that at one of the lower job complexity levels, the difference between schooling of the inflow and the outflow increases in cyclical downturns. At the same time, workers with surplus schooling earn somewhat lower wages at this job level. For the other job complexity levels we find no evidence for crowding out.

Keywords: unemployment, wages, job turnover: education, business cycle
JEL codes: J21, J23

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1 Introduction

Most European labor markets are characterized by both relatively high and relatively cyclical unemployment rates for lower educated workers. In recent literature: most attention has gone out to explain the relatively high stock of low skilled unemployment, see e.g. Layard et al. (1991), OECD (1996), Nickel1 and Bell (1996). There are four main explanations for this fact. First, skill biased technological change in an imperfect labor market can lead to a fall in the demand for lower educated workers. Second, increased competition and international trade leads to a change in the industrial structure. Third, wage floors like for example the minimum wage reduce labor demand for unskilled workers. Besides those three explanations which focus on the demand side, there is a fourth explanation which focuses on the supply side of the labor market. According to this explanation, unskilled workers have higher replacement rates when unemployed and thus they have less incentives to work.

The fact that the unemployment rate of lower educated workers increases relatively strongly in cyclical downturns (for evidence see e.g. Van Ours and Ridder, 1995)IS generally explained by the fact that firms typically invest more in job specific capital for highly educated workers. The highly educated workers will therefore be hoarded during recessions and the lower educated workers will be laid off. See e.g. Oi (1968) and Hamermesh (1993).[1]

In addition to the explanations just mentioned there is the less familiar explanation of "crowding out" of lower educated workers by workers with a higher education. This explanation has been rather popular in the Netherlands (see e.g. Asselberghs et al. (1997) and Teulings and Koopmanschap (1989) and has been used to explain both the high unemployment rates for lower educated workers (documented in Table 1) and the fact that low skilled unemployment is more cyclical.

One of the first models of job competition and crowding out was developed by Thurow (1975). In this model, the labor market is not a market of matching demand and supply for various job skills but one of matching trainable individuals with training ladders. Moreover, the marginal product is associated with jobs rather than with workers. In this view, the labor market is a closed system. When there is a fixed amount of jobs with fixed characteristics (including wages) and an excess supply of labor, it is likely that higher educated (and cheaper trainable) workers who cannot find a job will accept jobs below their level at the cost of workers with intermediate skills, who will in turn accept simple jobs. Finally, at the end of the line there are the lowest educated workers who become unemployed. The problem with this explanation is that the composition of va-

[1] Pfann and Palm (1990) give evidence that adjustment costs are much higher for white collar workers. Also note that when workers who become unemployed loose skills, there will be persistence in the level of low skilled unemployment and the distinction between cyclical and structural unemployment vanishes.

cancies does not adjust at all to the composition of the labor market. Moreover, both employers and workers who are employed below their job level can improve their position by forming better matches and it is therefore hard to believe that crowding out is a long lasting structural phenomenon. If one looks at cross country comparisons, the evidence also strongly suggests that countries with a highly educated labor force have relatively more complex jobs than countries with a relatively lower educated labor force. Similarly, we see that over a longer time span, both the fraction of simple jobs and the fraction of workers with a lower education has fallen. This suggests that in the long run, the composition of jobs and workers move in the same direction. There is also a fundamental measurement problem associated with structural crowding out since we never observe worker skills and job requirements exactly. It is therefore virtually impossible to correctly label someone to be overqualified for a particular job. One basically has to make the extreme assumption that the econometrician observes more than the individual firm and worker who have decided to form a match. Moreover, the job requirement is often not fully determined before the formation of a match. Hence, we cannot conclude from the simple fact that some workers with a higher education occupy simple jobs that crowding out takes place. It is therefore likely that crowding out, if present, is a cyclical phenomenon.[2]

An early model that allows for cyclical crowding out is the one by Okun (1981) who has suggested that in bad times it is costly to adjust wages and that firms will therefore increase their hiring standards instead. A different reason for cyclical crowding out is given by standard job search theory. When it takes time for workers and vacancies to find each other, a possible strategy for higher educated workers is to temporary accept a simple job and to continue searching for a more complex job which pays a higher wage. There are however also reasons to believe that cyclical crowding out is an unlikely outcome. McCormick (1990) shows for example that skilled workers may be reluctant to accept unskilled jobs even on a temporary basis because of fear of stigmatization. Therefore, unemployed higher educated workers tend to invest in job search, rather than take an interim position at an unskilled job.

The empirical evidence on the existence of cyclical crowding out is mixed. The general approach that has been followed is to relate a measure of labor market tension to the education-job level distribution. Teulings and Koopmanschap (1989) use regional differences in unemployment rates as a measure for labor market tension. They found that the relative change in the employment share of workers with a lower education at occupations for which, in general, only a lower education is required is lower in regions with high unemployment, and they therefore conclude that there is crowding out. A problem with this approach is

[2]Hecker (1992) has argued that from 1970 onwards, an increasing number of US college students were employed at "high school jobs". This paper got a lot of attention in the popular press. Tyler et al. (1995) showed however that during the 80's, the fraction of young college graduates at "high school jobs" declined and that their real earnings increased.

that the analysis focuses on occupations rather than job levels. It can therefore not be ruled out that the results are driven by differences in adjustment costs between workers with different education levels at the same occupations. Moreover, workers can move freely between regions. Van Ours and Ridder (1995) use V/U ratios of different labor market segments to test for cyclical crowding out. A necessary condition for crowding out in their model is that an unemployed worker is better of searching at lower level jobs. The approach of Van Ours and Ridder focuses at the supply side of the labor market. The idea is that crowding out takes place when the ratio of unemployed job seekers to vacancies in a particular segment exceeds the ratio of unemployed job seekers to vacancies in the lower neighboring segment. Only then, it becomes optimal to supply labor below one's level. Except for workers with an academic degree they find no evidence that the V/U ratio's are higher at lower labor market segments and they conclude that the disproportionately high unemployment rates for lower educated workers must be due to the higher firing rate that this group faces.

Van Ours and Ridder find that supply orientated cyclical crowding out is largely irrelevant. We focus on demand orientated (cyclical) crowding out. Our data allow us to directly test at the firm level whether the quality of the workforce increases during periods of high unemployment. The data we use are unique in the sense that they contain information on both worker, job and firm characteristics. Other advantages of our data are that they are based on administrative records, that the key variables for crowding out (education and job complexity level) are measured independently and that we observe both new and separating workers. If cyclical crowding out is important, firms require more schooling at given job complexity levels during bad times. We will therefore test whether the difference in years of schooling between the inflow and outflow of workers for a given job level in a particular firm, is larger during low employment years. Unlike some of the previous studies, which restricted crowding out to be an inflow phenomenon only, we will allow crowding out to be the result of a combination of inflow and outflow policies at the firm level. Moreover, we can directly observe whether upgrading is the result of the outflow of workers with a relatively lower education or whether it is caused by the inflow of workers with a relatively higher education, at given job levels.

An additional advantage of our data is that we have information on gross hourly wage data to distinguish between substitution and pure crowding out and that we can test whether the returns to schooling are still positive when we condition on job complexity levels. Our findings suggest that the wage differential between new workers who have followed relatively many years of schooling and their direct colleagues (in the same firm at the same job level) is almost zero.

The discussion on crowding out has also entered the policy arena. From a welfare point of view, crowding out can never be a first best solution since potential productivity is not used. It is therefore often argued that policy makers should stimulate job creation at the top segment of the labor market when crowding out exists (see e.g. Asselberghs et al. (1998)). This is sometimes called a "choking chimney" policy. If on the other hand, the high and cyclical unemployment rates for workers with a lower education are caused by any of the explanations mentioned at the beginning of this paper, policy makers could better directly focus at the bottom segment of the labor market. Another conventional wisdom is that when there is crowding out, there is no need for extra education of low skilled workers since those workers would occupy simple jobs anyway.[3] This view is also typically based on a static and mechanical view of the labor market. If crowding out is for example the result of search frictions, better schooling will lead to the opening of more complex job vacancies and will lower overall unemployment.

This paper is organized as follows. In Section 2 we discuss the data we use for testing the empirical relevance of crowding out and present some descriptive statistics. In section 3 we test to what extent employers exploit recessions to improve the average skill level of their work force at given job complexity levels. Finally in section 4, we investigate whether workers with relatively many years of education at a given job level earn higher wages than their direct colleagues at the same job level in the same firm.

2 Data and descriptive statistics

2.1 Data

For this paper we have used the AVO data set of the Department of Social Affairs and Employment which covers the period 1992-96. The data were originally collected to obtain information on the development of wage income for different categories of workers and are based on administrative records of firms by means of a stratified two step sampling procedure. In the first step a sample of firms is drawn from the Department's own firm register (which is roughly similar to the firm register of Statistics Netherlands).[4] In the second step a sample of workers is drawn within each of these firms.

At the first stage, a sample of firms was selected using a stratified (by industry and firm size) design. The number of strata changed between surveys. In 1993, the sample that we use consists of 1682 firms which were drawn from 80 strata, in 1994, the sample consists of 1563 firms from 280 strata, in 1995, the sample

[3]The following remarks from the popular press reflect this popular view. Robert Samuelson wrote in a Newsweek column of August 1992: " .*[If]* more people *had gone to college in the 1980's they would have competed mostly for lower-wage jobs that usually don't require a degree*". In the same year, Sylvia Nasar wrote an article with the suggestive title "More College graduates taking low-wage jobs" in the New York Times.

[4]Firms from the service sector and other semi-public sectors were included in all samples. Since the 1993 sample contained no information on public sector workers, we excluded this sector from the other samples as well.

contains 1375 firms from 312 strata, and in 1996 there are 1548 firms from 328 strata. Particularly firms with less than 10 employees are under-represented.

At the second stage, a sample of workers was drawn from the firms which were selected in the first step. This was done as follows. Prom small firms (<20 employees) the entire work force was sampled whereas for larger firms, the fraction of workers who were sampled decreases with firm size. Then, in October of year t, an aselect sample of workers from the wage administration of each firm was drawn and in addition information was obtained on the total outflow of workers within each firm. From the workers sampled at October of year t additional information on hours worked and wage earnings was obtained from the wage administration of October ($t-1$). Moreover, to obtain information on separating workers, a number of workers (consistent with the total outflow rate of the firm) who were present in October of year $t-1$ and who were not present at October of year t were drawn in addition. After this aselect sample of workers was drawn, it was checked whether minimally 10 workers had a collective wage agreement and 10 workers had no collective wage agreement and whether there were minimally 8 stayers, 8 new workers and 8 separating workers in the sample. If this was not the case, the worker sample was extended to obtain those minimum levels, except of course for those firms which employed, for example, less than 10 workers with a collective wage agreement or which hired less than 8 new workers. On average, more than 75% of the workers were present at both sample moments. When workers were only present at October t-l and not at October t (outflow): information was obtained on the new labor market state of the worker.[5]

Thus, the sampling probability for an individual worker depends on the probability that the firm is sampled and the probability that the worker is sampled within the firm, which in turn depends on the size of the firm. It depends indirectly (when less than a minimum level of a certain worker type was sampled) on the type of wage contract, whether the worker is a new entrant, a stayer or has left in the previous period. For each observation a weight (equal to the inverse of the sampling probability) was constructed. In addition, separate *firm weights* were constructed which are equal to the inverse of the sampling probability of the firm. When the unit of observation in our analysis is the firm, we use firm level weights while when the unit of observation is the individual, we use firm$*$worker weights to obtain population quantities. As mentioned before, only for some variables (wages, hours worked), information is available for both year t and $t-1$ but for the variable which measures the job complexity level this information is not available. Thus we have for example no information on promotions within firms between year t and $t-1$. In addition, we miss the workers who were hired after October $t-1$ and who left before October $t-1$. We have information

[5] The in- and outflow rates appear to be consistent with figures from other data sources (the Dutch Social Security Council), see Gautier (1997).

on gross wages (also on over time payments and profit shares), hours worked, days worked, education, job complexity level, occupation, age, tenure, gender, and type of wage contract. For a detailed description of the job complexity and education levels we refer to the appendix and to Venema (1996), Wiggers (1998), and Gautier (1998) in which the AVO data are compared with other sources.

The advantages of the AVO data are that we observe both worker and firm characteristics, and that it is based on administrative records so that we have very few missing observations. Moreover, the data contain detailed information on the in- and outflow of workers. Finally, education and job complexity, the key variables for crowding out are measured independently.

There is also a number of limitations. Due to the complex sample design and the many strata, some (firm) weights become extremely large. It turns out that this seriously influences certain key variables and leads to differences of the variables in our sample and the Dutch labor force survey (EBB), collected by statistics Netherlands. We therefore chose to remove the records with (worker*firm) weights larger than 500 from the sample (about 5% for each year). Those were mainly workers employed at small firms in small sectors. We have checked whether the new sample is more representative for the entire working population by comparing the distributions of a number of key variables over time and with the Labor Force Survey of the Central Bureau of Statistics and this seemed to be the case (although the weighted fraction of small firms in our sample is still larger in 1993 than in the other years.[6] Another disadvantage of this data set is that it does not contain any information on value added, output, profits, capital and investment.The main reason for this is that the data were designed to study wage growth and therefore only information from the wage administration of firms was obtained. Table 2 shows some characteristics of the AVO data. We see that most of the means of variables like age, gender and education, are quite stable over time. Also note that relatively more small firms and more workers with a (semi) collective wage agreement were present in the 1993 sample. In our formal tests of section 4 we will therefore have to control for those variables. The behavior of the education and job complexity distributions will be discussed at more length in the next section.

2.2 Descriptive statistics

First, we will show that 1993 and to a lesser extent 1994 can be considered to be bad years in terms of employment opportunities. The strong recovery of employment in the Netherlands started in 1995 and continued in the years thereafter. Table 5 shows that in 1993 unemployment increased strongly while few vacancies were created. In 1995 and 1996 unemployment fell and many vacancies were created. Moreover, the v/u ratios for almost all education groups,

[6] In our analysis in the next section we will however control for firm size

and in particular for those with only elementary school were lower in 1993 than in 1995 and 1996. This cyclical pattern is also present in the AVO data. From table 2, we see that the difference between the inflow and the outflow rates was substantially higher in 1995 and 1996 than in 1993 and 1994. In addition, the fraction of workers employed at shrinking firms was higher while the fraction of workers employed at growing firms was lower in 1993 and 1994 than in 1995 and 1996.

In Tables 3 and 4, we give information on the skill and education structure of jobs and workers based on four AVO surveys (92-93, 93-94, 9495 and 95-96). The samples of period t contain information on employment in period t and $t-1$. Since job complexity is only measured once, the differences in fractions of workers employed at a particular job complexity level between period t and $t-1$ in one sample can only be due to differences in the magnitude and composition of the inflow and outflow of workers. Thus, the differences in the education job complexity distribution across samples can be partly explained by the fact that we miss promotions within firms. We can however not rule out that some of the differences are due to sampling errors. Most of the empirical analysis of the next section will therefore be carried out for separate job complexity levels. We see from Table 3 (date t, survey t) that in 1993, 18.5% of all employed workers was reported to be employed at a simple job, in 1994 this was 21.3% while in 1995 this was 19.3% and in 1996, it was only 14.4%. At the same time we see from table 4 that in 1993, 60.9% had a lower education, in 1994, this fraction was 61.8%, in 1995 it was 58.4% and in 1996 it was 54.9%. The fractions of workers with primary school only for 1993-96 are respectively: 7.4%, 6.8%, 7.9% and 6.0%. Thus the 1996 sample contains a smaller faction of simple jobs and relatively fewer workers with a lower education than the other samples.

To get some ideas about the empirical relevance of crowding out in the mid 90's we will first' test whether a larger fraction of simple jobs was occupied by higher educated workers in the low employment year 1993. The results of our simple test on the existence of crowding out are shown in Table 7 which indicates that relatively fewer workers with an intermediate and higher education were employed at a simple job (level f1/f2) in the low employment years 1993 and 1994 than in 1995 and 1996.[7] In 1993, 6.9% of the workers at simple jobs had followed an intermediate or higher education and in 1994 this fraction was 7.3% while in 1995 and 1996, respectively 8.2% and 9.9% of the workers at simple jobs had completed at least an intermediate education. Thus in the high employment years, the average education level at simple jobs seems to be somewhat higher. Under crowding out, we would expect the opposite. The data also give information on the destination of exiting workers. Table 8 shows that workers with a lower education and workers employed at simple jobs have higher layoff rates than workers with a higher education and workers employed at complex jobs. This is

[7] Tables 18 -21 give a more extensive view on the distribution of workers over jobs.

consistent with the labor hoarding story we discussed at the beginning of this paper. The layoff rates are much higher for all worker and job types in the low employment year 1993. We also see that in the high employment years 1995 and 1996, the highly educated workers move more often to a new job while in the low employment years, the workers with a lower education move more often to a new job. It is likely that those decisions are based on different motivations. The lower educated workers who anticipate a layoff or dismissal during a downturn are likely to increase their search intensity while on the other hand, booms are typically periods when the rewards to search are much higher for workers with a higher education. As job search theory predicts, most job to job movements are from workers employed at simple jobs. It is more likely to find a better position when one is employed at the bottom of the job ladder than at the top.

The descriptive statistics in this section show that recessions are not periods in which more highly educated workers occupy simple jobs. We do find evidence that lay off rates for workers with a lower education are higher than for workers with a higher education. In the next section we will test whether there is evidence for crowding out at the firm level.

3 A test on cyclical crowding out

In this section we directly test the hiring and firing policy of firms with respect to the education requirements of their work force. As mentioned before, the hypothesis we test is very much related to Okun's (1984) idea that employers are often reluctant to lower wages during bad times and instead increase education standards for given jobs.

Unlike previous studies, which have been based on aggregate data, our data allow us to directly test to what extent employers increase their education standards in periods of increasing unemployment. In the next section we explicitly define a variable which measures the difference between average education requirements for the inflow and for the outflow at a given job complexity level in a given firm. We test whether this variable is larger during bad times. In the remaining of this section, we say more on the educational requirements over the cycle for inflow and outflow separately and in addition we test for selectivity bias.

3.1 Do firms upgrade their work force in bad times?

In this section we perform a direct test of the hypothesis that firms increase the educational level of their work force during bad times. Since the sort of activities within a particular job complexity level can change over the cycle we have to define a job at the lowest possible aggregation level. Below we explain how we measure upgrading.

Let y_{jk}^{in} be the average number of years of education for the inflow into job complexity level k at firm j and let y^{out}_{jk} be the average number of years of education for the *outflow* from job complexity level k at firm j.[8] We will assume that the amount of required schooling for both inflow and outflow at each job complexity level depends on observable firm characteristics, job specific effects and macro-economic conditions, which are captured by calendar time dummies.

$$y^{in}_{jk} = \alpha^{in}_{jk} + \beta^{in}_{k} x_{jt} + \sum_{t=93}^{95} \sum_{k=1}^{K} \gamma^{in}_{kt} d_{kt} + \varepsilon^{in}_{jk} \tag{1}$$

$$y^{out}_{jk} = \alpha^{out}_{jk} + \beta^{out}_{k} x_{jt} + \sum_{t=93}^{95} \sum_{k=1}^{K} \gamma^{out}_{kt} d_{kt} + \varepsilon^{out}_{jk} \tag{2}$$

where α^{in}_{jk} and α^{out}_{jk} are fixed job effects, β^{in}_{k} and β^{out}_{k} are coefficient estimates of the firm effects, x_{jt} is a vector with firm characteristics in year t, γ^{in}_{kt} and γ^{out}_{kt} are coefficient estimates of the calendar time effects, d_{kt} is a dummy which is equal to 1 for job complexity level k and year t and zero otherwise and ε^{in}_{jk} and ε^{out}_{jk} are i.i.d. error terms.

If firms increase education standards for certain jobs, we expect that in 1993, in which unemployment grew strongly, the difference between the years of education for the inflow and the outflow at given job complexity levels, will be higher than in the high employment years 1995 and 1996. Thus the effect of d_{k93} on $(y^{in}_{jk} \quad y^{out}_{jk})$ gives us information on potential upgrading of firms. Before we can estimate those effects, we will assume that the firm effects have the same value in both the inflow and the outflow equations but we will allow the job effects to differ, hence $\alpha^{in}_{jk} - \alpha^{out}_{jk} = \alpha'_{k}$. Thus we estimate

$$(y^{in}_{jk} - y^{out}_{jk}) = \alpha'_{k} + \beta_{k} x_{jt} + \sum_{t=93}^{95} \sum_{k=1}^{K} \gamma_{kt} d_{kt} + \varepsilon_{jk} \tag{3}$$

The results can be found in table 9. For most job complexity levels, the effect of d_{k93} on $(y^{in}_{jk} - y^{out}_{jk})$ is zero or even negative (relative to d_{k96}). Only for job complexity level 2 it is significantly positive with a coefficient estimate of 0.31 (s.e. is 0.15).[9] We also see that during our sample periods, the mean of $(y^{in}_{jk} - y^{out}_{jk})$ was positive for all job complexity levels and that most of the upgrading took place at intermediate job complexity levels. It is still interesting to see how the inflow and outflow equations behave separately and whether turnover is higher under

[8] We excluded retirements from the outflow because the older cohort has in general followed a relatively lower education and occupies relatively complex jobs. Including this cohort did however not lead to any changes of our conclusions.

[9] We could not reject the joint hypothesis that the coefficient estimates of the 1993 dummies are zero in all equations ($F[5,4319]=1.13$). Moreover, we experimented with a recession dummy which takes the value 1 in 1993 and 1994 and zero otherwise. For none of the job complexity levels we found a sign&cant effect of the recession dummy. We also could not reject the hypothesis that the recession dummy was zero in all equations, $F[5,4341]=0.87$.

low skilled workers. This will be the subject of the next section. In addition we will check to what extent our results are disturbed by selectivity bias.

3.2 Sensitivity analyses and the quality of new and separating workers over the cycle

To get an idea on potential sample selection effects, we will check whether the fact that both in and outflow are observed has a significant effect on the calendar time dummies for the inflow and outflow equations. Those equations also give information on the cyclical behavior of the education requirements for new workers and whether recessions are periods in which mainly workers with a lower education separate from a given job. Thus consider the following equations:

$$y_{jk}^{in} = \alpha_{jk}^{in} + \beta_k^{in} x_{jt} + \phi_k^{in} n_{jk}^{out} + \sum_{t=93}^{95} \sum_{k=1}^{K} \gamma_{kt}^{in} d_{kt} + \xi_{kt}^{in} d_{kt} n_{jk}^{out} + \varepsilon_{jk}^{in} \tag{4}$$

$$y_{jk}^{out} = \alpha_{jk}^{out} + \beta_k^{out} x_{jt} + \phi_k^{out} n_{jk}^{in} + \sum_{t=93}^{95} \sum_{k=1}^{K} \gamma_{kt}^{out} d_{kt} + \xi_{kt}^{out} d_{kt} n_{jk}^{in} + \varepsilon_{jk}^{out} \tag{5}$$

Where n_{jk}^{in} and n_{jk}^{out} take the value 1 when respectively inflow and outflow are observed and zero otherwise. An F-test on the joint significance of ϕ_k^{in} and ξ_{kt}^{in} and of ϕ_k^{out} and ξ_{kt}^{out} will tell us something about different behavior of the firms for which we observe both in- and outflow simultaneously. Tables 10 and 11 show that for job complexity levels 1,3 and 4 we cannot reject the null hypothesis that ϕ_k^{in} and ξ_{kt}^{in} are zero. Including $\phi_k^{in} n_{jk}^{out}$ and $\xi_{kt}^{out} d_{kt} n_{jk}^{in}$ in the inflow equation leads to a somewhat smaller effect of the 1993 dummy. For the outflow equation, we have to reject the null hypothesis that ϕ_k^{in} and $\xi_{kt}^{in} d_{kt}$ are zero for job complexity levels 3 and 6-8. Those tables also learn us that in 1993, the average education of both in- and outflow was close to zero or negative (relative to 1996). The estimates for all job levels together even show a significantly negative effect for both the education of the in- and outflow in the low employment years. In the appendix we compare the hiring and firing behavior of firms over a number of sub samples to learn more about selectivity and in addition we re-estimate equations 1 and 2 with the two-stage Heckman (1979) method. Tables 16 and 17 show that the coefficient estimates of the selectivity terms are insignificant for all job levels of the outflow equations (except for the one based on the entire sample) and significantly positive for job complexity levels 1 and 3. The coefficient estimates of the 1993 dummy are however almost equal to the ones in Tables 10 and 11.

To sum up, we cannot rule out that some of our estimates of the previous section are biased because of sample selection. The separate estimates for in- and outflow do show that in the low employment year 1993, the average education of the inflow did not increase (for all job levels together it even decreased significantly) but that the average education level of the outflow level did in general strongly decrease. This suggests that if any form of upgrading takes place in periods of high unemployment, this is the result of outflow of workers with a relatively low education.

4 Do higher educated workers earn more at simple jobs than lower educated workers?

Next, we test whether the wage earnings of workers who have followed relatively many years of schooling at a given job complexity level are higher or lower than the wages of other workers at. the same job complexity level within the same firm. In other words, we test whether, conditioning on job complexity levels, the returns to schooling are still positive. If this is the case, it is likely that the workers with more schooling are also more productive on those jobs. When workers with relatively many years of schooling at their job level earn less than the other workers this could be caused by a number of things. Firstly, it can reflect a wage penalty which the workers with surplus schooling have to pay because of their larger quit probability. This is consistent with equilibrium search models of the Pissarides (1990) type. When a worker with a higher education would temporarily accept a job below his level and would continue searching for a better job he needs to produce sufficiently more on this job than the workers with a lower education to compensate the employers for the smaller match surplus (caused by his larger quit probability). Alternatively it could reflect a lower productivity of the workers with surplus schooling. It is for example possible that highly educated workers are less productive on simple repeating activities than lower educated workers. Finally, observed negative returns to schooling at given job levels can be the result of unobserved characteristics of those workers, for which we cannot control, like for example type of study and social skills. In the literature, workers who have more education than required for a certain occupation are sometimes labeled to be overschooled . We prefer to avoid this term because, although it is possible to measure required schooling, it is very hard to determine whether someone is overschooled or not. This is due to the fact that the productivity of a job depends on both worker, firm and match characteristics. Instead, we will define a new variable, z^*_{ijk}, for every worker and job pair, which equals: $(w_{ijk} - \bar{w}_{jk})$ where w_{ijk} is the log of the hourly wage of worker i at firm j at job complexity level k and $\bar{w}_{jk}$ is the log of the average hourly wage at job complexity level k in firm j. Thus we compare the wage of each worker with the average wage at the same job complexity level in the same firm the worker is employed at. This enables us to check whether higher educated workers are more productive on simple jobs and whether the returns to schooling at a given job complexity level change over the business cycle. Since we want to allow required schooling at a given job complexity to vary across firms, we will define the variable $s^*_{ijk} = (ed_{ijk} - \bar{ed}_{jk})$, where ed_{ijk} is the amount of schooling (in years) of worker i at firm j at job level k and $\bar{ed}_{jk}$ is the average amount of education at job level k in firm j. We can now regress z^*_{ijk} on various firm and worker characteristics , on s^*_{ijk} and on calendar time.

$$z^*_{ijk} = \beta_{1k}x_{ijk} + \beta_{2k}s^*_{ijk}\sum_{t=93}^{95}\sum_{k=1}^{K}\gamma_k d_{kt} + \nu_{ijk} \tag{6}$$

where x_{ijk} contains both firm and worker characteristics. We have restricted our analysis to the inflow of new workers at period t because only then we are sure to capture the firm's wage policy during period t and we don't have to bother about the endogeneity of tenure.[10] Also note that we now use the individual as unit of observation and that we have to weight accordingly." When the process of upgrading the work force actually leads to a higher productivity, it is more appropriate to talk about substitution than about crowding out. Under substitution, we expect that at a given job complexity level, workers with a higher education earn higher wages. From Table 12 we see that new workers with relatively many years of schooling earned almost the same as the other workers at simple jobs, although the coefficient for job complexity level 2 is significantly negative and for job complexity level 3 it is significantly positive. This result might be puzzling to those who are familiar with the literature on "overschooling". Duncan and Hoffman (1981), Rumberger (1987), Hersch (1991), Hartog and Oosterbeek (1985) and other studies surveyed in Hartog (1998) all found that the rewards to surplus schooling are positive. None of those studies corrected however for fixed firm effects. To get a better idea of the differences between our results and those found in the literature on overschooling, we have repeated our estimates without correcting for fixed firm effects (the coefficient estimates with s.e.'s of the schooling variable are presented in the last two rows of Table 12). Except for job level 1, the coefficient estimates for the effects of schooling on gross hourly wages turn out to be highly significant in this case. This suggests that workers with relatively many years of schooling (given their jobs) tend to select themselves into high wage firms and that the results of the "overschooling" literature are mainly driven by selectivity effects.[12] Our findings suggest that the workers with relatively many years of schooling compared to their direct colleagues use their education as a compensation for a lack of other skills.

Furthermore, we see that at f3-f5, females earn significantly less than males even if we control for job levels. Not included in the table are the effects of shrinking and growing firms. Only for f5 we found a significant negative effect of the "growing firm" dummy on z^*_{ijk}, although the value was small (0.05, s.e.

"This is also the reason why for each job complexity level the mean of z_{ijk} is negative.

[11]WLS was necessary because more than 300 strata were used in the sample and we therefore could not include all cross products of firm and size classes on the right hand side of the equations. Weighted and unweighted regressions gave however very similar results.

[12]See Hartog (1998) for a discussion of other measurement problems related to overschooling.

0.02). Also not included are the effects of a collective wage agreement which was only significantly positive for f3 (0.02, s.e: 0.01).

5 Conclusion

Cyclical crowding out is the process where lower educated workers at simple jobs are replaced by higher educated workers in periods when jobs are relatively scarce. Crowding out as explanation for the high and cyclical unemployment rate of lower educated workers has become increasingly popular in the Netherlands. There are however many other possible reasons for those facts. Therefore, if we really want to take crowding out serious, it has to be supported by the data. Our results suggest that in periods of low employment, less workers with an intermediate or higher education are employed at simple jobs, which is inconsistent with crowding out. In addition, we find that for all job types, the average education went up in the first half of the nineties. For intermediate jobs, the average difference between years of schooling of the in- and outflow of workers is highest.

Only for one of the lower job complexity levels we find evidence that firms upgraded their work force in the low employment year 1993. For the other 5 job complexity levels we find no evidence for upgrading during recession years. We also find no evidence that the average education of the inflow increased during recession but we did find strong evidence that, in particular during low employment periods, workers with relatively few years of completed education separate more frequently than higher educated workers.

New workers with a relatively high education earn about the same as their colleagues at the same job level at the same firm in the same year. For job complexity level 3 (which contains by far the most workers), we find that workers with relatively many years of schooling earn slightly (but statistically significant) more than their direct colleagues at the same job level in the same firm while at job complexity level 2, workers with relatively many years of schooling earn slightly less (but statistically significant) than their direct colleagues. The general evidence is thus that workers with relatively many years of schooling at given job complexity levels are not more productive at those jobs than their direct colleagues. The difference between our results and the results in the literature on "surplus schooling" is driven by the fact that we take account of firm specific effects. It turns out that workers with relatively many years of schooling (compared to other workers at the same job level) select themselves into high wage firms.

We also conclude that the evidence for crowding out is very thin. As far as it takes place, it is more outflow driven than inflow driven. If crowding out would have been an important reason for the high unemployment rate of lower educated workers, policy makers should stimulate job creation at the top segments of the labor market to encourage higher educated workers to leave simple jobs. Our results suggest however that it is more likely that lower educated workers become unemployed because their jobs are not productive enough any more. Policies to reduce unemployment of lower educated workers should therefore focus directly on the lower segment of the labor market. One can think of decreasing the cost of creating lower educated jobs by means of tax incentives, stimulate the training of lower educated workers, or allow firms to temporary lower their wages in bad times.

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Appendices

A Sensitivity analyses

The estimates of Table 9 potentially suffer from selectivity bias since we observe $(y_{jk}^{in} - y_{jk}^{out})$ only for a limited amount of firms. To get an idea of the importance of this problem we will take two approaches. First, we will compare the hiring and firing behavior of a number of sub samples with each other to check to what extent the firms for which we observe simultaneous in and outflow at a given job complexity level behave differently from firms at which we observe only inflow or only outflow at given job complexity levels. Secondly, we reestimated equations **1** and **2** using the two-stage sample selection bias correction approach of Heckman (1979).

The variables n_{jk}^{in} and n_{jk}^{out} take the value 1 when respectively inflow and outflow are observed and zero otherwise. Let the equations that determine the sample selection be:

$$n_{jk}^{in} = \delta_{jk}^{in} + \kappa_k^{in} x_{jt} + \sum_{t=93}^{95}\sum_{k=1}^{K} \zeta_{kt}^{in} d_{kt} + \eta_{jk}^{in} \tag{7}$$

$$n_{jk}^{out} = \delta_{jk}^{out} + \kappa_k^{out} x_{jt} + \sum_{t=93}^{95}\sum_{k=1}^{K} \zeta_{kt}^{out} d_{kt} + \eta_{jk}^{out} \tag{8}$$

Since the sampling rule is that $(y_{jk}^{in} - y_{jkt}^{out})$ is observed when both n_{jk}^{in} and $n_{jk}^{out} > 0$ we get an unbiased estimator for $E(y_{jk}^{in} - y_{jk}^{out}|x_{jt}, n_{jk}^{in} > 0\ n_{jk}^{out} > 0)$ when $(\varepsilon_{jk}^{in} - \varepsilon_{jk}^{out}) \perp (n_{jk}^{in}, n_{jk}^{out})$. In that case we can estimate the effect of $(\gamma_{k93}^{in} - \gamma_{k93}^{out})$ on the conditional mean of $(y_{jk}^{in} - y_{jk}^{out})$ by WLS. To test this, we will compare the coefficient estimates of γ_{k93}^{in} and γ_{k93}^{out}, (for the low employment year 1993) based on different subsets of our sample, with each other. Consider the following equations (in terms of conditional expectations).

a $E(y_{jk}^{in} - y_{jk}^{out}|x_{jt}, n_{jk}^{in} > 0, n_{jk}^{out} > 0)$

b $E(y_{jk}^{in}|x_{jt}, n_{jk}^{in} > 0)$

c $E(y_{jk}^{in}|x_{jt}, n_{jk}^{in} > 0, n_{jk}^{out} \leq 0)$

d $E(y_{jk}^{in}|x_{jt}, n_{jk}^{in} > 0, n_{jk}^{out} > 0)$

e $E(y_{jk}^{out}|x_{jkt}, n_{jk}^{out} > 0)$

f. $E(y_{jk}^{out}|x_{jt}, n_{jk}^{in} \leq 0, n_{jk}^{out} > 0)$

g $E(y_{jk}^{out}|x_{jt}, n_{jk}^{in} > 0, n_{jk}^{out} > 0)$

Comparing (b) , (c) and (d) gives information to what extent η_{jk}^{out} is independent of ε_{jk}^{in} and η_{jk}^{in}. We see from Tables 13-15 that in specification (d), the effect of the low employment year 1993 on the education level of the inflow is somewhat more negative then for specifications (b) and (c) at job levels 1 and 2 while for job level 3 it is slightly more positive. Comparing (e), (f) and (g) gives information to what extent η_{jk}^{in} is independent of ε_{jk}^{out} and η_{jk}^{out}. From the same tables we see that for job levels 1 and 3, the coefficient of the 1993 dummy is positive or less negative for specification (g) while for job level 2 it is more negative. Finally, comparison of (b-e) with (a) , (c-f) with (a) and (d-g) with (a) gives us information on the dependence of $(\varepsilon_{jk}^{in}, \varepsilon_{jk}^{out})$ and $(\eta_{jk}^{in}, \eta_{jk}^{out})$. For job levels 2 and 3 we are likely to overestimate the upgrading effect in 1993 by restricting the analysis to firms for which we observe both in- and outflow at given job complexity levels while for job level 1 we are likely to underestimate the upgrading effect in 1993.

An alternative way to test and correct for some of the sample selection bias is to estimate the in- and outflow equations with Heckman's (1979) two-step estimation procedure. The coefficient estimates of the inverse Mill ratio, $\beta_{\lambda k}^{in}$ and $\beta_{\lambda k}^{out}$ gives us information on the selectivity bias.[13] Tables 16 and 17 show that those coefficient estimates for the selection terms are significant for job levels 1, 3 and 5 of the inflow equations and insignificant for all job levels of the outflow equation.

B AVO data

The AVO data were collected by the Dutch "Labor inspection" (AI) which is part of the department of Social Affairs and contains administrative data from workers employed in both the private and the public sector. For our analysis we only used workers who were employed in the private sector. Below we give a more detailed description on the construction of some of the key variables.

Job complexity levels
Simple

f1 Very simple activities which do not change over time. No schooling is necessary and only limited experience. The activities are under direct supervision.

f2 Simple activities which are in general repeating. Some (lower) administrative or technical knowledge and experience is required. In general the activities take place under direct supervision.

[13]In the probits with n_{jk}^{in} and n_{jk}^{out} as dependent variables, we included the same exogenous variables as in the regressions of Table 9 since there are no obvious variables which affect the years of schooling of the inflow and the outflow but do not influence the fact that we observe either in or outflow, the identification of the Heckman model depends fully on the parametric assumptions.

Intermediate

f3 Less simple activities which do not repeat themselves continuously. Administrative or technical knowledge is required and the activities are partly without direct supervision.

f4 More difficult (non-repeating) activities for which an intermediate level of education is required. In general the activities take place without direct supervision.

High

f5 Activities within a certain field which require a higher level of knowledge and experience. The activities take place without direct supervision.

f6 Managing activities of an analytical, creative or contact nature: which are undertaken independently and require an university or comparable level.

f7 Managers of intermediate companies or comparable plants, departments etc. who also participate in decision making.

f8 Managers of large companies or comparable plants or departments.

In this paper we merged f7 and f8 and when reported f6-8 because of the few observations in f8 and f7

Education

We have information on 7 types of schooling (total years, including the required schooling to enter a particular type of education, between brackets):
Lower: primary, sl (6), junior general, s2 (10) and pre-vocational, s3 (10)
Intermediate: senior general, s4 (12) , senior vocational, s5 (14)
Higher vocational colleges, s6 (15) and university, s7 (16).

outflow

Workers not older than 60 years who left a firm because of (early) retirement, disability, their test-period ended, layoff, displacement, they reported to have found a new job or they were initially hired from a temporary employment office. We do not observe movements between jobs within firms.

inflow

Workers who enter a new firm. Again, we do not observe within firm labour flows.

tenure:

Measured in years (difference between starting and sampling date).

wage

Monthly wages (including extra time payments, profits shares etc.) and hours worked are measured very accurately. We calculated nominal gross hourly wages for each worker and deflated the wage by the consumer price index to obtain real wages.

wage agreement

We distinguish 3 types of wage contracts. Most workers have a collective wage agreement (CAO) which is bargained over at the sectoral level. The minister of social affairs has the right to force all firms within a sector to pay the same collectively bargained wage (AW) and finally there are workers who have a bilateral bargained wage contract. Those workers are in general employed at higher positions..

part- time /full-time

Part-time refers to working less than 100% of the regular number of hours

occupation

We have information on the following occupations : (1) simple technical activities, (2) administrative, (3) computer: (4) commercial, (5) service orientated, (6) creative. (7) management.

sector

Although the AVO data contain information on the public sector we restricted our analysis to the private sector. We distinguish 12 sectors. (1) agriculture and fishing, (2) food, (3) chemical, (4) metal, (5) other industry, (6) construction (7) trade, (8) hotels, restaurants catering, (9) transport: communication, (10) banking and insurance, (11) other services, (12) health care

firm size

We have used the following size classes. (I) l-9 , (2) 10-19, (3) 20-49 (4), 50-99, (5)100-199, (6) 200-499, (7) $\geq$ 500 employees.

C Tables

Table 1: Unemployment rates for different education classes

	% Unemployed	Share of labor force
primary	15	**8**
junior general	**9**	**22**
senior general, pre-vocational	**6**	**44**
vocational colleges	5	17
university	6	8
total	7	**100**

Note: Source: Statistics Netherlands, EBB (1996)

Table 2: AVO data: weighted means **1993-96**

variable	93	94	95	**96**
workers employed at shrinking firm (%)	30.6	30.4	24.6	26.5
workers employed at growing firm (%)	33.2	39.0	44.8	41.6
male (%)	62.9	64.4	62.3	64.0
female (%)	37.1	35.6	37.7	36.0
inflow (% of total employment)	11.8	10.8	13.4	13.8
outflow (% of total employment)	11.0	8.7	9.6	**10.0**
collective wage agreement (CAO, AW) (%)	74.1	78.7	77.0	76.4
age (years)	35.8	35.9	36.0	36.0
completed education (years)	11.2	11.2	11.3	11.5
real gross hourly wage (Dutch guilders)	25.9	24.1	26.7	27.2
tenure (years)	7.5	8.0	7.5	7.8
firm size (1-19 employees)	87.8	79.7	80.8	81.0
firm size (20-49 employees)	7.1	12.5	11.4	11.1
firm size (50-99 employees)	2.2	4.3	4.4	3.3
firm size (100-199 employees)	1.1	1.9	1.7	1.6
firm size (200-499 employees)	0.8	1.1	1.0	1.1
firms (>500 employees)	0.3	0.4	0.5	0.7
# workers	24053	31250	26059	36380
# firms	1682	1563	1375	1548

Vote: Individual records are weighted by individual*firm weights: firm records are weighted by firm weights

Table 3: Allocation of workers over job complexity levels (in %)

date	sample	f1	f2	f3	f4	f5	f6	f7	total
Oct 92	**93**	2.7	15.2	46.7	20.9	10.3	3.8	0.5	100
Oct 93	**93**	2.8	15.7	46.3	20.8	10.0	3.8	0.5	100
Oct 93	**94**	4.6	15.5	47.5	21.0	8.5	2.6	0.2	100
Oct 94	**94**	5.0	16.3	46.9	20.7	8.4	2.5	0.2	100
Oct 94	**95**	5.0	13.5	47.6	21.6	9.1	3.0	0.2	100
Oct 95	**95**	5.2	14.1	47.3	21.2	9.0	2.9	0.2	100
Oct 95	**96**	3.1	10.2	47.1	24.7	11.9	2.8	0.2	100
Oct 96	**96**	3.5	10.9	47.1	23.9	11.7	2.8	0.1	100

Note: date refers to calendar time. The figures represent (fractions of) stocks of workers. Differences between samples are partly due to the fact that we do not observe promotions within firms.

Table 4: Allocation of workers over education classes (in %)

date	sample	s1	s2	s3	s4	s5	s6	s7	total
Oct 92	**93**	7.7	13.2	40.2	8.4	18.4	9.4	2.6	100
Oct 93	**93**	7.4	13.3	39.9	8.7	18.6	9.5	2.7	100
Oct 93	**94**	7.1	12.5	42.8	7.1	19.3	8.9	2.3	100
Oct 94	**94**	6.8	12.8	42.2	7.4	19.3	9.1	2.5	100
Oct 94	**95**	8.0	13.5	37.3	7.8	20.0	10.3	3.2	100
Oct 95	**95**	7.9	13.6	36.9	8.0	19.9	10.5	3.3	100
Oct 95	**96**	6.1	14.6	34.7	8.5	20.7	12.2	3.2	100
Oct 96	**96**	6.0	14.5	34.4	8.9	20.4	12.4	3.4	100

Note: date refers to calendar time. The figures represent (fractions of) stocks of workers. Differences between samples are partly due to the fact that we do not observe formal training between 2 sample periods.

Table 5: Labor market conditions: 1993-96

Indicator	93	94	95	96
unemployment change %	22.7	15.4	-6.7	-6.6
employment change (%, EBB)				
persons	-0.1	0.4	2.1	2.1
man year	-0.5	-0.3	2.1	1.7
new vacancies x1000	383	438	526	571
filled vacancies x1000	396	428	508	561
employment x1000	5754	5778	5897	6016

Note: Source Statistics Netherlands. EBB is the Dutch Labor force study

Table 6: V/U ratio's for a high and a low employment year

V/U	93	95	96	93/95	93/96
primary	0.002	0.030	0.040	0.067	0.050
junior general	0.169	0.038	0.038	4.445	4.445
pre- vocational	0.068	0.133	0.133	0.511	0.511
senior general	0.025	0.075	0.052	0.328	0.481
senior vocational	0.076	0.172	0.156	0.574	0.487
vocational colleges	0.099	0.194	0.217	0.510	0.456
university	0.035	0.075	0.126	0.467	0.278

Note: Source Statistics Netherlands

Table 7: Allocation of workers over jobs 1993-96 (in %)

job level	**f1,f2**				**f3,f4**				**f5-f8**			
education	**93**	**94**	**95**	**96**	**93**	**94**	**95**	**96**	**93**	**94**	**95**	**96**
lower	93.1	92.7	91.8	90.1	63.0	61.5	58.7	58.4	6.5	4.8	3.4	3.5
intermediate	6.5	6.9	7.2	8.9	32.8	33.1	34.9	34.8	28.4	25.7	21.3	22.9
higher	0.4	0.4	1.0	1.0	4.2	5.5	6.4	6.8	65.1	69.5	75.3	73.7

Table 8: Outflow by education and job complexity level (in %)

	education			**job complexity level**		
	s1-s3	s4,s5	s6,s7	f1,f2	f3,f4	f5-f8
layoff						
93	8.3	7.2	7.7	10.4	7.4	6.2
94	2.6	1.4	1.2	2.8	2.0	1.3
95	2.1	1.5	2.1	2.8	1.7	1.4
96	2.4	1.4	1.0	2.5	1.8	0.7
to other job						
93	1.5	0.9	0.8	2.4	1.0	0.5
94	4.4	3.9	4.2	5.4	3.9	3.7
95	5.8	5.1	6.0	7.1	5.2	6.8
96	5.8	6.0	6.3	6.5	5.9	5.4
total outflow						
93	12.7	10.2	10.5	16.2	10.8	8.4
94	10.4	7.6	7.7	13.1	8.3	7.6
95	11.3	9.0	10.0	14.7	9.4	9.3
96	11.4	9.7	9.4	14.2	10.0	8.2

Table 9: Coefficient estimates of WLS with $(y_{jk}^{in} - y_{jk}^{out})$ as dependent variable

job complexity level	**f1**	**f2**	**f3**	**f4**	**f5**	**f6-8**	**all**
N	218	928	1931	810	349	113	4349
$y_{jk}^{in} - y_{jk}^{out}$ mean	0.18 17.7	0.25 0.03	0.32 0.02	0.52 0.04	0.31 0.15	0.24 0.46	0.32 0.01
α_k	-0.20	-0.36	0.64	1.08	-0.12	1.18	0.37
s.e	0.81	0.27	0.18	1.11	2.61	0.35	0.14

Note: Including sector, firm size and year dummies. Only for f2 a significant positive effect was found for the low employment year dummy 1993 (0.31, s.e. 0.15, relative to 1996). Unweighted estimates gave qualitatively similar results. Coefficient estimates which are significant on the 95 % level are printed in bold. We could not reject the hypothesis that the 1993 dummy was zero in all equations, $(F[6,4319] = 1.17)$

Table 10: Coefficient estimates of WLS with outflow dummies and y_{jk}^{in} as dependent variable

job complexity level	f1	f2	f3	f4	f5	f6-8	all
N	478	1765	2937	1448	757	297	7682
y_{jk}^{in} mean	9.05	9.83	10.97	13.41	14.84	15.6	11.4
R^2	0.13	0.03	0.09	0.11	0.12	0.22	0.12
α_{jk}^{in}	**9.79**	**9.61**	**11.04**	**14.30**	**15.04**	**15.28**	**10.72**
s.e	(0.49)	(0.19)	(0.15)	(0.37)	(0.45)	(0.20)	(0.14)
1993	**-0.62**	0.01	0.02	**-0.24**	-0.14	0.09	**-0.26**
s.e.	(0.28)	(0.12)	(0.09)	(0.12)	(0.10)	(0.13)	(0.07)
1994	-0.32	**0.33**	-0.08	0.20	0.00	-0.07	**-0.27**
s.e	(0.28)	(0.13)	(0.09)	(0.13)	(0.10)	(0.16)	(0.08)
1995	-0.35	0.04	**-0.11**	0.05	-0.00	**0.34**	**-0.21**
s.e.	(0.26)	(0.13)	(0.09)	(0.12)	(0.09)	(0.15)	(0.08)
out	**-3.20**	**-1.16**	**-0.78**	**0.96**	-0.22	-0.00	**-0.44**
s.e	(0.25)	(0.46)	(0.21)	(0.25)	(0.28)	(1.50)	(0.18)
out93	1.43	**1.23**	0.18	**-1.12**	0.69	-0.05	-0.26
s.e	(1.07)	(0.57)	(0.27)	(0.46)	(0.54)	(1.60)	(0.25)
out94	**3.88**	**1.14**	**0.82**	**-1.76**	**0.61**	-0.06	0.02
s.e	1.13	(0.57)	(0.34)	(0.51)	(0.74)	(1.65)	(0.28)
out95	**3.16**	**1.59**	0.26	**-1.24**	-0.03	0.35	0.16
s.e	1.12	(0.58)	(0.34)	(0.43)	(0.48)	(1.53)	(0.28)
$F_{(4,n-21)}$	5.25	1.80	7.09	4.01	0.62	0.19	6.25

Note: WLS estimates. Coefficients which are significant on the % level are printed in bold. Including sector and firm size dummies. The F-test is on the joint significance of ϕ_k^{in} and ξ_{kt}^{out}

Table 11: Coefficient estimates of WLS with inflow dummies and y_{jk}^{out} as dependent variable

job complexity level	f1	f2	f3	f4	f5	f6-8	all
N	357	1432	2705	1405	721	299	6943
y_{jk}^{out} mean	8.44	9.46	10.47	12.96	14.38	15.22	11.36
R^2	0.17	0.04	0.12	0.09	0.11	0.36	0.12
α_{out}	9.64	9.86	**9.91**	**12.56**	**14.11**	**16.84**	**10.25**
s.e	(0.72)	(0.25)	(0.14)	(0.42)	(0.97)	(1.11)	(0.15)
1993	**-1.25**	**-0.14**	-0.03	-0.54	-0.28	**-0.34**	**-0.41**
s.e.	(0.37)	(0.15)	(0.08)	(0.13)	(0.15)	(0.17)	(0.08)
1994	-0.10	0.00	-0.04	-0.17	-0.16	-0.18	-0.48
s.e	(0.36)	(0.17)	(0.09)	(0.14)	(0.18)	(0.20)	(0.09)
1995	-0.08	-0.17	0.32	0.03	0.15	0.20	-0.12
s.e.	(0.37)	(0.17)	(0.08)	(0.14)	(0.17)	(0.18)	(0.08)
in	0.86	0.46	0.24	0.43	0.14	-0.40	-0.03
s.e.	(0.46)	(0.28)	(0.17)	(0.27)	(0.32)	(0.38)	(0.16)
in93	-0.33	-0.14	0.39	-0.11	0.08	-0.87	0.04
s.e.	(0.82)	(0.35)	(0.23)	(0.41)	(0.51)	(0.51)	(0.22)
in94	**-1.67**	**-0.14**	0.08	-0.72	-0.03	0.65	0.18
s.e.	(0.70)	(0.40)	(0.27)	(0.45)	(0.53)	(0.50)	(0.25)
in95	-0.24	-0.06	-0.62	-0.07	-0.91	-0.39	0.17
s.e.	(0.87)	(0.45)	(0.28)	(0.40)	(0.60)	(0.89)	(0.26)
$F_{(4,n-k)}$	1.62	1.82	6.10	1.42	0.59	4.34	0.41

Note: WLS estimates. Coefficients which are significant on the % level are printed in bold. Including sector and firm size dummies. The F-test is on the joint significance of ϕ_k^{in} and ξ_{kt}^{in}

Table 12: Coefficient estimates of WLS regression with z^*_{ijk} as dependent variable (for the inflow only) variable

job complexity level	fl	**f2**	**f3**	f4	f5	**f6-8**	all
N	1061	3663	7283	2734	1243	375	16359
z_{ijk} mean	-0.08	-0.11	-0.13	-0.14	-0.16	-0.27	-0.13
R^2	0.33	0.33	0.34	0.20	0.26	0.24	0.19
α_k	-8.26	-11.29	-12.20	-6.71	-9.81	4.70	-6.99
s.e	(0.61)	(0.43)	(0.32)	(0.82)	(1.62)	(4.28)	(0.21)
s_{ijk}	-0.00	-0.006	0.005	0.00	0.00	-0.09	0.00
s.e.	(0.005)	(0.002)	(0.002)	(0.004)	(0.01)	(0.06)	(0.001)
1993	-0.01	0.03	0.04	0.02	0.01	-0.07	0.03
s.e.	(0.02)	(0.01)	(0.01)	(0.013)	(0.02)	(0.05)	(0.01)
1994	-0.07	0.01	0.02	-0.01	0.00	0.11	0.02
s.e	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.06)	(0.01)
1995	-0.04	-0.02	-0.05	-0.02	0.00	-0.14	-0.03
s.e.	(0.02)	(0.01)	(0.01)	(0.012)	(0.02)	(0.05)	(0.01)
log age	4.72	6.51	6.80	3.54	5.00	-2.99	3.76
s.e.	(0.36)	(0.24)	(0.19)	(0.47)	(0.91)	(2.42)	(0.13)
$(\log \text{age})^2$	-0.66	-0.92	-0.94	-0.46	-0.63	0.48	-0.51
s.e.	(0.05)	(0.04)	(0.03)	0.07	0.13	(0.34)	(0.02)
female	-0.01	-0.01	-0.013	-0.05	-0.06	-0.08	-0.003
s.e.	(0.01)	(0.01)	(0.006)	(0.01)	(0.02)	(0.05)	(0.004)
yrs schooling (no firm effects)	0.004	0.007	0.014	0.011	0.012	0.09	0.05
s.e.	(0.004)	(0.002)	0.002	0.003	0.009	0.032	0.001

Note: z^*_{ijk} is the difference between the real gross hourly wage of individual i at job complexity level level k at firm j and the average real gross wage at job level k at firm j, s_{ijk} is equal to the difference between the amount of schooling (in years) of individual i at job complexity level k at firm j and the average amount of schooling (in years) at job level k at firm j. Including industry, size, firm shrink and grow, CAO, AW and part time dummies. Age is measured in years. The last two rows refer to estimates without fixed firm effects (log hourly wage was the dependent variable). CAO refers to a collective wage agreement and AW refers to a sector binded (by the minister) wage agreement. For the pooled regression, the coefficient estimate of CAO was 0.02 (0.005) and for AW it was 0.03 (0.008), for shrinking firms it was 0.01 2 (0.006) and for growing firms it was 0.02 (0.005). Reference states are ' year 1996', 'firms which did not change size, 'bilateral wage agreement', 'male'. Coefficient estimates which are significant on the 95 % level are printed in bold. The F statistic for the hypothesis that $s_{ij}1 = s_{ij}2 = . = $ sij6 = 0, is equal to $F[5, 16289] = 3.25$

Table 13: Estimates on different sub samples for job complexity level 1

	specification					
	b	c	d	e	f	g
α_k	**9.64**	**9.78**	**7.61**	**9.96**	**9.71**	**8.97**
s.e	(0.50)	(0.51)	(1.48)	(0.71)	(0.81)	(1.38)
1993	**-0.65**	**-0.63**	-0.85	**-1.42**	**-1.30**	-0.47
s.e.	(0.28)	(0.28)	(0.72)	(0.32)	(0.37)	(0.67)
1994	-0.15	-0.32	-0.60	-0.50	-0.11	-0.44
s.e	(0.27)	(0.28)	(0.63)	(0.32)	(0.36)	(0.59)
1995	-0.21	-0.35	**-1.48**	-0.26	-0.05	0.40
s.e.	(0.26)	(0.26)	(0.65)	(0.33)	(0.37)	(0.60)

Note: The specifications refer to the ones in A1. Including sector and firm size dummies.

Table 14: Estimates on different sub samples for job complexity level 2

	specification					
	b	c	d	e	f	g
α_k	**9.57**	**9.62**	**10.82**	**9.93**	**9.86**	**11.38**
s.e	(0.19)	(0.20)	(0.45)	(0.24)	(0.27)	(0.45)
1993	0.06	0.01	-0.07	-0.15	-0.14	**-0.83**
s.e.	(0.12)	(0.08)	(0.28)	(0.14)	(0.16)	(0.29)
1994	**0.38**	**0.33**	-0.14	-0.02	-0.01	-0.24
s.e	(0.12)	(0.13)	(0.30)	(0.15)	(0.17)	(0.30)
1995	0.12	0.04	-0.26	-0.20	-0.18	-0.47
s.e.	(0.13)	(0.13)	(0.30)	(0.16)	(0.18)	(0.31)

Note: The specifications refer to the ones in section A1.

Table 15: Estimates on different sub samples for job complexit,y level 3

	specification					
	b	c	d	e	f	g
α_k	10.94	11.26	11.44	9.95	**9.94**	**9.78**
s.e	(0.15)	(0.15)	(0.30)	(0.14)	(0.14)	(0.28)
1993	0.01	0.02	0.29	0.01	-0.02	0.14
s.e.	(0.08)	(0.09)	(0.16)	(0.07)	(0.08)	(0.14)
1994	-0.02	-0.07	0.29	-0.04	-0.04	0.19
s.e	(0.09)	(0.09)	(0.16)	(0.08)	(0.08)	(0.15)
1995	-0.08	-0.11	0.24	0.26	**0.33**	**0.58**
s.e.	(0.09)	(0.09)	(0.16)	(0.08)	(0.08)	(0.14)

Note: The specifications refer to the ones in A1

Table 16: Coefficient estimates of WLS with Heckman correction and y_{jk}^{in} as dependent variable

job complexity level	fl	f2	f3	f4	f5	f6-8	all
α_{jk}^{in}	**9.24**	**9.40**	**10.81**	**14.37**	**15.22**	**15.35**	**10.56**
s.e	(0.56)	(0.21)	(0.15)	(0.39)	(0.46)	(0.22)	(0.14)
1993	-0.65	0.07	0.02	-0.34	-0.08	0.17	-0.28
s.e.	(0.28)	(0.12)	(0.08)	(0.11)	(0.09)	(0.14)	(0.07)
1994	**-0.13**	**0.38**	-0.02	0.08	0.04	-0.02	-0.27
s.e	(0.27)	(0.12)	(0.09)	(0.13)	(0.10)	(0.16)	(0.08)
1995	-0.22	0.13	-0.07	-0.05	0.02	0.42	-0.20
s.e.	(0.26)	(0.13)	(0.09)	(0.11)	(0.09)	(0.14)	(0.07)
λ_{in}^{in}	0.30	0.12	0.25	0.03	-0.18	-1.03	0.02
s.e	(0.15)	(0.07)	(0.04)	(0.06)	(0.04)	(0.53)	(0.03)

Note: 2-step Hecman selection estimates. Coefficient estimates which are significant on the 95 % level are printed in bold. Including sector and firm size dummies. Identification depends on parametric assumptions only.

Table 17: Coefficient estimates of WLS with Heckman correction and y_{jk}^{out} as dependent variable

job complexity level	fl	f2	f3	f4	f5	f6-8	all
α_{jk}^{out}	**10.46**	**10.14**	**10.06**	**12.62**	**14.23**	**16.88**	**10.25**
s.e	(0.76)	(0.26)	(0.14)	(0.43)	(0.98)	(1.15)	(0.16)
1993	-1.34	-0.15	0.01	-0.55	-0.25	-0.40	-0.41
s.e.	(0.33)	(0.14)	(0.07)	(0.12)	(0.14)	(0.17)	(0.07)
1994	-0.46	-0.00	-0.03	-0.24	-0.16	-0.07	-0.46
s.e	(0.32)	(0.15)	(0.08)	(0.14)	(0.17)	(0.18)	(0.08)
1995	-0.21	-0.19	0.26	0.04	0.08	0.18	-0.14
s.e.	(0.34)	(0.16)	(0.08)	(0.13)	(0.16)	(0.18)	(0.08)
λ_{out}^{o}	-0.25	-0.07	-0.04	0.03	0.10	0.06	**-0.11**
s.e	(0.14)	(0.07)	(0.04)	(0.60)	(0.07)	(0.07)	(0.04)

Note: 2-step Hecman selection estimates. Coefficient estimates which are significant on the 95 % level are printed in bold. Including sector and firm size dummies. Identification depends on parametric assumptions only.

Table 18: Allocation of workers over jobs **1993**

job complexity level	yr	f1	f2	f3	f4	f5	f6	f7,8	% of total
education	**93**								
primary		**51.7**	**23.9**	**4.1**	**1.0**	0.4	0.3	0.0	7.4
junior general		15.4	28.7	15.1	4.7	2.7	2.2	0.8	13.3
pre-vocational		29.1	39.9	60.7	19.7	3.7	4.0	3.0	39.9
senior general		2.2	4.7	8.0	15.8	7.2	4.4	1.6	8.7
senior vocational		1.1	2.5	11.4	46.7	25.5	15.7	2.7	18.6
vocational colleges		0.5	0.3	0.6	11.3	53.3	34.1	37.2	9.5
university		0.0	0.0	0.1	0.8	7.3	39.4	54.7	2.7
% of total		2.8	15.7	46.3	20.8	10.0	3.8	0.5	**100**

Table 19: Allocation of workers over iobs **1994**

job complexity level	yr	fl	f2	f3	f4	f5	f6	f7,8	% of total
education	**94**								
primary		43.6	16.9	3.7	0.8	0.2	0.0	1.5	6.8
junior general		28.5	27.7	12.6	3.9	1.5	0.5	0.6	12.8
pre-vocational		24.0	47.0	61.9	18.9	4.4	0.6	0.0	42.2
senior general		2.3	4.6	7.8	11.5	4.8	2.1	2.4	7.4
senior vocational		1.6	3.2	12.8	49.9	25.7	9.2	2.9	19.3
vocational colleges		0.0	0.4	1.2	14.1	54.2	35.6	36.6	9.1
university		0.0	0.2	0.1	0.8	9.3	52.1	55.6	2.5
% of total		5.0	16.3	46.9	20.7	8.4	2.5	0.2	100

Table 20: Allocation of workers over jobs 1995

job complexity level	yr	f1	f2	f3	f4	f5	f6	f7,8	% of total
education	**95**								
primary		48.1	22.8	4.4	0.4	0.1	0.0	0.0	7.9
junior general		22.0	28.5	15.8	3.9	1.3	0.5	0.0	13.6
pre-vocational		24.2	39.6	56.4	14.5	2.8	0.8	0.0	36.9
senior general		2.8	5.1	8.2	12.7	5.6	1.4	1.0	8.0
senior vocational		1.9	3.1	13.6	51.4	21.6	3.0	1.5	19.9
vocational colleges		1.0	0.6	1.4	15.9	60.9	25.4	16.4	10.5
university		0.0	0.4	0.2	1.2	7.7	68.9	81.1	3.3
% of total		5.2	14.1	47.3	21.2	9.0	2.9	0.2	100

Table 21: Allocation of workers over jobs 1996

job complexity level		**yr**	**fl f2**	**f3**	**f4**	**f5**	**f6**	**f7,8**	**% of total**
education	**96**								
primary		47.3	22.7	3.7	0.6	0.2	0.0	0.0	6.1
junior general		21.7	27.2	20.4	4.2	1.4	0.2	**0.0**	14.5
pre-vocational		23.9	39.4	54.5	13.8	2.4	1.2	**0.0**	34.4
senior general		4.5	6.5	7.5	16.3	4.7	2.0	1.2	8.9
senior vocational		1.4	3.4	12.3	48.0	21.5	8.1	1.6	20.4
vocational colleges		1.0	0.6	1.4	15.2	58.7	38.0	42.3	12.4
university		0.2	0.3	0.2	1.9	11.2	50.5	55.0	3.4
% of total		3.5	10.9	47.1	23.9	11.7	2.8	0.1	**100.0**